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MOTOROLA
SEMICONDUCTOR
USER'S MANUAL

M68HC705UPGMR
May, 1995

M68HC705UPGMR
UNIVERSAL PROGRAMMER
USER'S MANUAL

Second Edition

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CHAPTER 1

INTRODUCTION

The M68HC705UPGMR Universal Programmer Board provides economical and reliable solutions for programming a wide range of MC68HC705 family's Microcontroller units (MCUs). It is designed with a versatile hardware platform to support programming of different MCUs/packages via the use of Programmer Adaptor Boards.

The M68HC705UPGMR can be configured to program MCUs using either serial or parallel programming mode.

In the parallel mode the data required to be programmed to all onboard MCUs' internal PROM (OTPROM/EPROM and/or EEPROM) is held in an external EPROM, while in the serial mode the data to be written is supplied from a remote computer via the serial communication link.

1.1 M68HC705UPGMR FEATURES

M68HC705UPGMR features include :

- Economical means of programming OTPROM, EPROM and EEPROM of a wide range of CSIC M68HC705 family MCUs.
- Parallel and serial programming mode of operations.
- RS232 terminal port.
- 28-pin DIP ZIF socket for target code 27C256 EPROM.
- Single +5Vdc supply voltage requirement.
- Two 32-pin DIN male connectors for target MCU Universal Programmer Adaptor (UPA).
- Supports various MCUs/packages.

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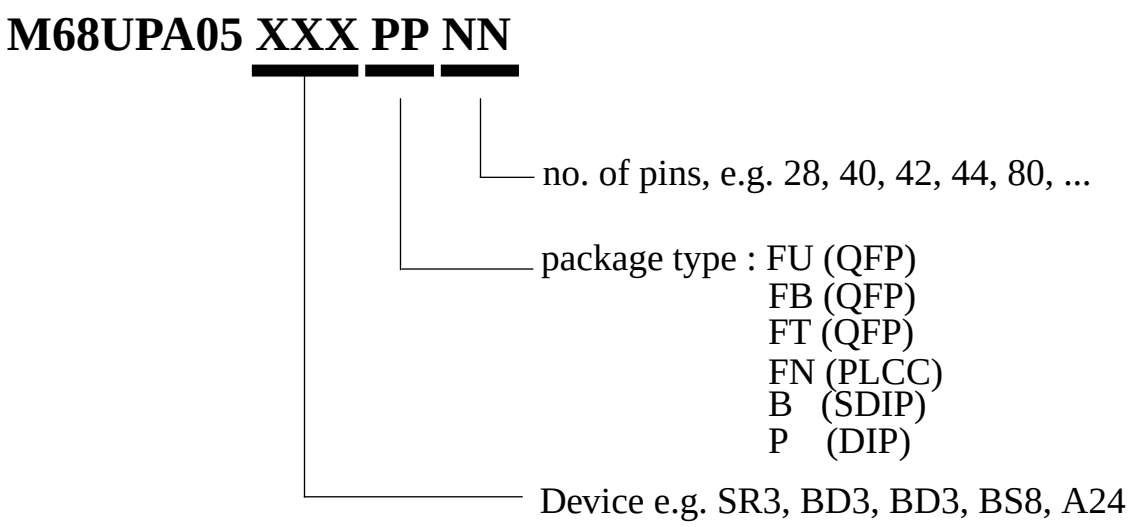
1.2 OVERVIEW

Each MC68HC705 family's MCU, supported by the M68HC705UPGMR Universal Programmer Board, is equipped with a built-in bootstrap program in its mask rom areas. This bootstrap program together with the M68HC705UPGMR and Universal Programmer Adaptor (UPA) enable programming of OTPROM, EPROM and EEPROM on MC68HC705 family's MCUs.

Universal Programmer Adaptors (UPAs) are not shipped with the M68HC705UPGMR. Users are required to order the appropriate UPA separately for the MCU type/packages they use. Ordering part number for various UPAs use the following numbering scheme :



Additionally, user must provide +5 volts power to the M68HC705UPGMR, and :

- a 25 lead serial communication cable for serial mode operations.
- or, an industry standard 27C256 EPROM for parallel mode operations.

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1.3 ORGANISATION OF THIS MANUAL

The remaining chapters of this user's manual are arranged as follows :

- Chapter 2, "Hardware Preparation" explains how to connect/setup the hardware for serial and parallel programming operations.

- Chapter 3, "Parallel Mode" explains the parallel programming operations, instructions to copy the contents of an industry standard 27C256 EPROM into target MCU memory.

- Chapter4, "Serial Mode" explains the serial programming operations, and how to use the serial interface software commands.

- Chapter 5, "Support Information" explains the serial connector pin assignment, signal descriptions, and troubleshooting guide.

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CHAPTER 2

HARDWARE PREPARATION

This chapter explains hardware preparation for your M68HC705UPGMR Universal Programmer Board.

2.1 M68HC705UPGMR BOARD LAYOUT

Figure 2.1 shows a simplified layout of the M68HC705UPGMR Universal Programmer Board. Connector P1 is for +5Vdc power. Connector P2 is the terminal I/O port. U3 is the socket for an external 27C256 EPROM. Jumper header P5 determines the address range of the target MCU. The rotary switch SW1 determines the operating mode of the programmer board. Switch SW2 is the power on/off switch.

To program MCU of a particular type or package, insert the required Programmer Adaptor Board via connectors P6 and P7. Figure 2.2 shows the general layout of a Programmer Adaptor Board.

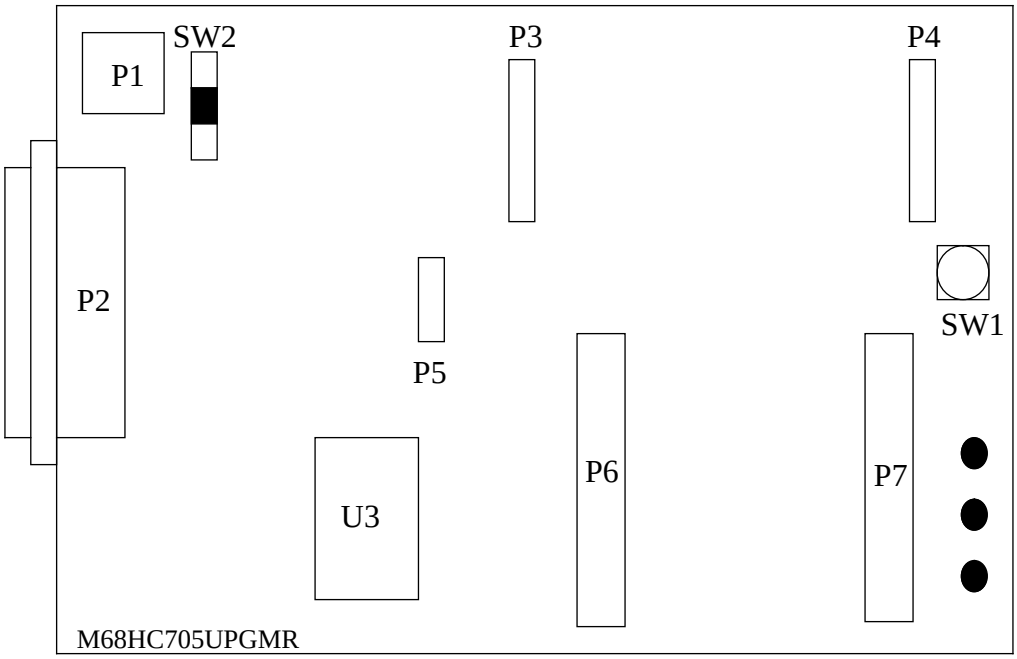

Figure 2-1 Universal Programmer Board Layout

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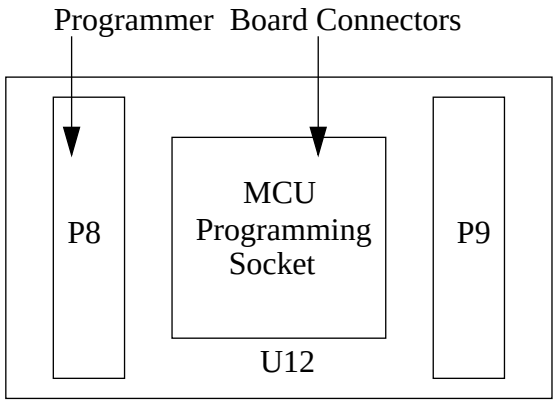

Figure 2-2 A Typical Universal Programmer adaptor Board Layout

2.2 MAKING SYSTEM CONNECTIONS

The M68HC705UPGMR can be configured to operate in parallel or serial modes each of which is dealt with separately in the following paragraphs.

2.2.1 STAND-ALONE PARALLEL MODE CONNECTIONS

This section describes the hardware connections required to program MCU on board the M68HC705UPGMR from an external 27C256 EPROM. Follow these instructions to make hardware connections:

1. Program the required contents of the target MCU OTPROM, EPROM and/or EEPROM into an industry standard 27C256 EPROM, refer to section 3.1 for detailed format.

2. Ensure the power supply switch SW2 is at its OFF position.

3. Install the required Universal Programmer Adaptor, UPA, into connectors P6 and P7 of the M68HC705UPGMR board.

4. Install a fabricated jumper to header P5 to select the “Out Of Bound” address line, e.g. for $0000 - $1FFF (8K memory map) range install jumper at A13, for $0000 - $1FFF (8K memory map) range install jumper at A13, for $0000 - $3FFF (16K memory map) range install jumper at A14, for $0000 - $7FFF (32K memory map) range install jumper at A15, for $0000 - $FFFF

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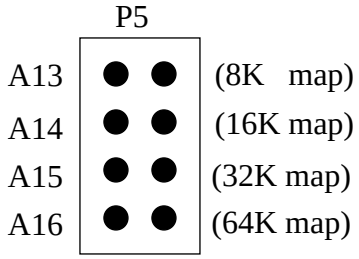
(64 K memory map) range install jumper at A16. The diagram below depicts jumper header without any fabricated jumper.



5. Install the target code 27C256 EPROM into the ZIF socket U3.

6. Use connector P1 to connect a +5 volts power and ground to the programmer board.

System connections are completed, ready to proceed programming, refer to Chapter 3 for stand-alone parallel programming procedures.

2.2.2 SERIAL MODE CONNECTIONS

This section describes the hardware connections required to program MCU from an 80x86 Compatible PC via a 25-pin serial cable. Serial RS232 connection to a PC requires a user supplied cable with one end of the cable fitted with a male DB25 connector, refer to chapter 5 for the DB25 connector pin assignments. The other end of the serial cable needs the appropriate connector for the serial communication port of the PC. Follow these instructions to make hardware connections:

1. Switch off the computer.

2. Ensure the power supply switch SW2 of the programmer board is at its OFF position.

3. Connect a serial cable between the programmer board connector P2 and the COM1 or COM2 serial port of the computer.

Note : The COM1 port is the default port used by the serial programmer software. User can specify either COM port when running the serial interface software.

4. Install the required Universal Programmer Adaptor Board into connectors P6 and P7 of the programmer board.

5. Turn the rotary switch SW1 on the programmer adaptor board to position 3 to select “Load

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Ram".

6. Use connector P1 to connect a +5 volts power and ground to the programmer board.

Note : Address jumper P5 and the ZIF socket U3 are both ignored in serial mode and have not effect on the programming operations.

System connections are completed, ready to proceed programming, refer to Chapter 4 for serial programming procedures.

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CHAPTER 3

PARALLEL PROGRAMMING MODE

This chapter describes how to copy the contents of a 27C256 EPROM into the EPROM and EEPROM memories of the MCU(s) on board the M68HC705UPGMR Universal Programmer Board. Prepare the programmer hardware for this operation by referring to section 2.2.

3.1 PREPARING THE EXTERNAL 27C256 EPROM

The user must supply a 27C256 EPROM programmed with the data to be copied into the MCU on board the programmer. The 27C256 EPROM should be prepared using either of the following methods accordingly :

- For MCU with memory map not exceeding 32K bytes (i.e. $0000 - $7FFF) the 27C256 must contain the data to be programmed into the MCU at the same address require for the target MCU type (i.e. direct mapping). For example, if data $5A is required at address $1234 in the target MCU then the 27C256 must contain the data $5A at address $1234 also. Unused locations should be filled with $FF.

- For MCU with memory map larger than32K bytes direct address mapping is no longer applicable. The 27C256 EPROM must contain data to be programmed into the MCU between address $8000 - $FFFF (32K bytes), hence location $0000 of the 27C256 EPROM corresponding to location $8000 of the target MCU, $0001 of the 27C256 corresponding to $8001 of the MCU and so on as illustrated in Figure 3-1 below.

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Note : Un-used locations should be filled with $FF

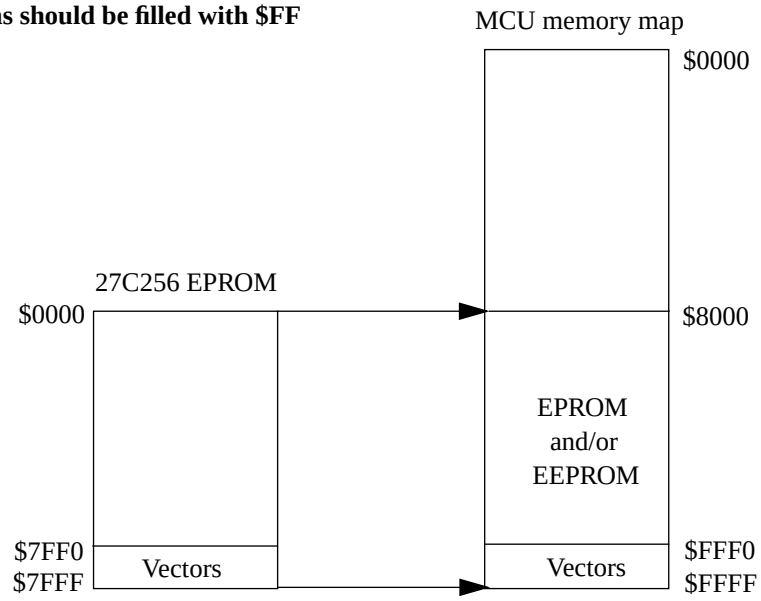

Figure 3-1 Memory maping between 27C256 EPROM and MCU with memory map >32K

SW1 Position	MODE
0	PROG EPROM - Program MCU EPROM from an external 27C256 EPROM (Parallel operation).
1	VERF - Verify MCU EPROM and EEPROM memories with external EPROM (Parallel operation).
2	BLANK CHK - Blank check MCU EPROM and EEPROM memories (Parallel operation).
3	LOAD RAM - Serial programming mode.
6	PROG EEPROM - Program MCU EEPROM from an external 27C256 EPROM (Parallel operation).

Table 3-1 M68HC705UPGMR Programmer Mode Functions

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3.2 STAND-ALONE PARALLEL MODE OPERATING PROCEDURE

Four parallel mode operations are available as shown in Table 3-1 and user can select the mode they require via the rotary switch SW1. During a parallel mode operation the STATUS LED flashes to indicate normal operation in progress. Unsuccessful operation will result in illumination of the ERROR LED. Successful operation will result in illumination of the VERIFY LED.

Perform the following steps to PROGRAM EPROM, PROGRAM EEPROM, VERIFY or BLANK CHECK MCU(s) on board the programmer:

1. Make sure that the power switch SW2 on the M68HC705UPGMR is at its OFF position.
2. Carry out the hardware connections for stand-alone parallel mode operations as described in section 2.2.1.
3. Insert MCU to be programmed into UPA.
4. Select one of the following four parallel mode operations, refer to table 3-1 for mode function:
   - PROGRAM EPROM - Turn the rotary switch SW1 to position 0 to select the EPROM programming and verification operation.
   - VERIFY - Turn the rotary switch SW1 to position 1 to select the verification operation.
   - BLANK CHECK - Turn the rotary switch SW1 to position 2 to select the blank checking operation.
   - PROGRAM EEPROM - Turn the rotary switch SW1 to position 6 to select the EEPROM programming and verification operation.
5. Switch the power switch to the ON position to begin operation. During processing, the STATUS LED will flash. If the MCU fails the ERROR LED will light to indicates an error. Successful operation will result in illumination of the VERIFY LED.
6. Switch the power switch SW2 to OFF position.
7. Go back to step 3 if other stand-alone parallel mode operation is required or remove MCU from the UPA.
8. To program more MCUs, go to step 3.

Note : Never turn off the programmer power while programming operation is in progress; doing so could corrupt data.

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CHAPTER 4

SERIAL PROGRAMMING MODE

This chapter explains how to operate the M68HC705UPGMR Universal Programmer Board from an 80x86 compatible PC.

4.1 THE SUPGMR05 SERIAL INTERFACE SOFTWARE

A serial interface software called SUPGMR05 is supplied with the M68HC705UPGMR Universal Programmer Board. The SUPGMR05 program lets user to read and program MCU memory via the serial connector P2 equipped on the programmer board.

Serial mode operations consist of downloading user code from a host computer, programming user code into the MCU EPROM and/or EEPROM memories, and uploading the MCU memory contents to the host computer for display or verification using instruction opcodes preloaded into the MCU RAM. The preloading of instruction opcodes into the MCU RAM are carried out automatically by the serial interface program SUPGMR05.

4.2 HARDWARE AND SOFTWARE REQUIREMENTS

The minimum hardware and software requirements your computer system needs to run the SUPGMR05 successfully are shown in the following list :

- MS-DOS version 3.3 or above.
- A PC with 286 processor (or higher), 640K of conventional memory, serial ports, colour VGA display, keyboard, and at least one floppy drive.
- A mouse or compatible with software driver, though it is optional, a mouse is highly recommended so that you can take advantage of the easy-to-use graphical interface.

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4.3 LOADING THE SERIAL INTERFACE SOFTWARE SUPGMR05

Before you can use the M68HC705UPGMR to program MCUs serially, you must load the SUPGMR05 software into your host computer. Load the SUPGMR05 into your host computer as follows :

1. Insert the SUPGMR05 software diskette into the appropriate drive of your computer.

2. Copy all files of the diskette onto the hard disk of your computer. Note that it is probably best to copy all of the supplied files into a unique directory (e.g. UPGMR) and add the directory name to the **PATH** and **APPEND** statements in the *autoexec.bat* file of your computer.

3. Remove the diskette. This completes software loading.

Note : It is possible to run the SUPGMR05 software from a floppy diskette. If doing so is appropriate for your situation, disregard the instructions above. Instead, make a working copy of the diskette, then store the original diskette safely.

4.4 PROGRAMMING PROCEDURES

Perform the following steps for serial mode operations :

1. Make sure that +5v power to the programmer is OFF. Set the power switch SW2 on the programmer to OFF.

2. Prepare the M68HC705UPGMR hardware for serial mode operations by referring to section 2.2.2.

3. Bring up the DOS prompt on the computer, then run the serial programming interface program by typing SUPGMR05 <CR> at DOS prompt.

4. Switch the power switch SW2 on the programmer to ON position.

5. The SUPGMR05 will be run and the main menu screen appears (section 4.2 explains this screen).

6. *Program, Verify* or *Display* the contents of the target MCU by selecting appropriate item(s) from the on screen menu(s) (section 4.3 explains each item available on each menu).

7. When all the operations have been completed, proceed to one of the steps below :

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- To program another MCU go to step 8.
- To quit, go to step 9.

8. To program another MCU set the power switch SW2 to OFF. Carefully remove the MCU from the UPA and insert another MCU. Repeat the process from step 4.

9. To quit, set the power switch SW2 to OFF. Careful remove the MCU. Remove power from the programmer board. Terminate SUPGMR05 operation by selecting the "Quit" item from the TOP MENU, if a mouse is available, or press Alt+Q to quit.

4.5 THE SOFTWARE INTERFACE BASICS

The SUPGMR05 provides user with all the necessary serial programming and related operations in a multi-level pull down menus screen display environment. Commands are selected from menus using either the keyboard or mouse (if available). The software will automatically check if mouse hardware and driver are installed on the computer system. If so, a graphical mouse pointer (an arrow) will be displayed on the screen. There are four visible components in the interface environment; the Menu Bar at the top, the Display Area in the middle, the Help Line and the Title name at the bottom. Figure 4-1(a) shows what the environment look like.

4.5.1 USING MENUS

When the environment is first invoked the Menu Bar will be active. The Menu Bar is the primary access to all menu commands and is always visible. The Help Line reminds the user the basic keystrokes applicable at that moment in the active menu/window. The help line message changes as user switch menu or activities.

As illustrated in Figure 4-1(a), there are six menu names available on the Menu Bar. When a menu name is selected the corresponding menu will pop down from the Menu Bar. A set of commands are then made available, see the example in Figure 4-1(b). Use either of the following methods to select a command from a menu :

- **Keyboard** : Hold down "Alt" and press the "Red Character" key of the command name.
- **Mouse** : Move mouse pointer to highlight a menu title or a command name and press mouse button once.

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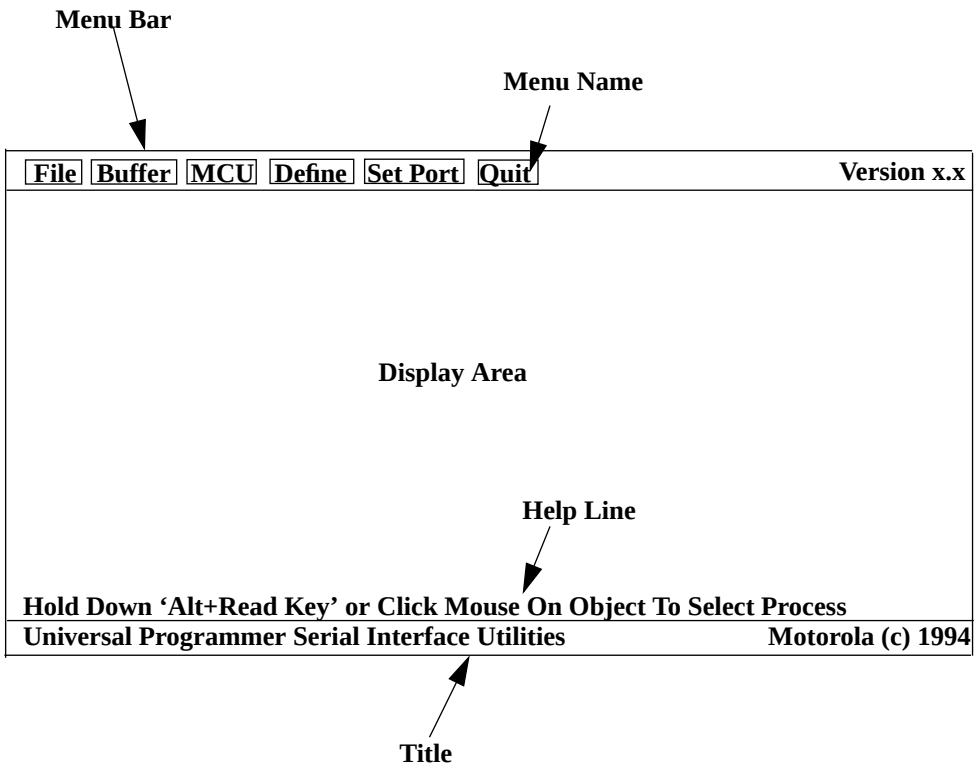

Figure 4-1(a) SUPGMR05 Interface Environment

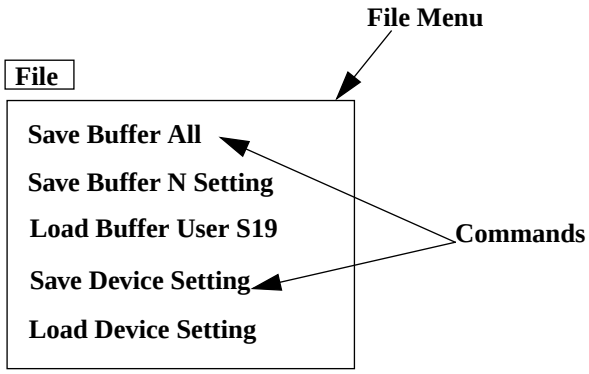

Figure 4-1(b) The Pop Down File Menu

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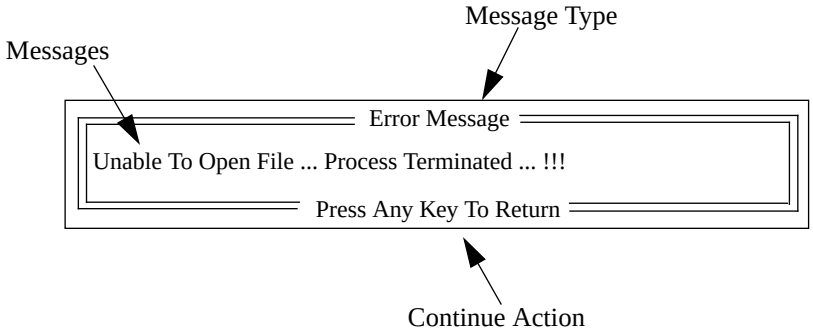
4.5.2 MESSAGE WINDOWS

Message windows let user know what the software is doing or tell the status of the selected operation. There are two types of colour coded message window; a green message window tells the status of an operation and a red message window displays error messages. Each message window contains three components; message type, message(s), and acknowledge method as shown in the example below.



4.6 MENUS AND OPERATIONS REFERENCE

This section provides a reference to commands available in each menu. Table 4-1 below lists the most used keystrokes to access the top Menu Bar.

Keystroke	Menu	Function
Alt + F	File Menu	Takes user to the File Menu.
Alt + B	Buffer Menu	Takes user to the Buffer Menu.
Alt + M	MCU Menu	Takes user to the MCU Menu.
Alt + D	Define Menu	Takes user to the Define Menu.
Alt + S	Set Port Menu	Takes user to the Set Port Menu.
Alt + Q	Quit	Exits the SUPGMR05 interface and return to DOS

Table 4-1 Menu Bar Keystrokes

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4.6.1 File MENU (Alt+F)

File menu lets user load/save the contents of memory buffer and target MCU parameters from/to disk. All commands available in this menu open a 'File Name' input window. The 'File Name' input window allows user to specify (i.e. type in) the file for the select operation. User needs only to provide a file name without extension, the interface software will add the appropriate file extension, e.g. '.S19', automatically. The following paragraphs provide an explanation of each command in the File menu.

Save Buffer All (Alt+A)

This command saves the contents of the target MCU memory buffer to disk (in Motorola S19 format). File extension '.S19' will be added to the file name given by the user.

Save Buffer N Setting (Alt+N)

This command saves the following two types of data to disk :

- the contents of memory buffer to 'file_name.S19' file
- the current target MCU parameters to 'file_name.MUD'. The extension '.MUD' stands for Motorola Universal Programmer Data file.

Load Buffer User S19 (Alt+9)

This command reads the contents of a S19 format file to the computer memory buffer.

Save Device Setting (Alt+S)

This command saves the current target MCU parameters (including Memory Map and Programming Control Register(s) addresses) to disk. File extension '.MUD' will be added to the file name given by the user.

Load Device Setting (Alt+L)

This command reads the target MCU parameters to the computer memory; specify the Memory Map and Program Control Register(s) addresses.

4.6.2 Buffer MENU (Alt+B)

Buffer menu lets user to block fill and screen dump the contents of the target MCU memory buffer. The following paragraphs provide an explanation of each command in the Buffer menu.

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Fill Buffer $FF (Alt+F)

This command fills the defined memory buffer with Hex. value $FF.

Fill Buffer $00 (Alt+0)

This command fills the defined memory buffer with Hex. value $00.

View EPROM Buffer (Alt+V)

This command opens the 'EPROM BUFFER CONTENTS' window, displays the memory buffer contents on the screen. Figure 4-2 shows what this window looks like. The window contains two data areas, scrolling and ESC buttons. Scrolling buttons lets user to scroll the data display up/down. ESC button exits and closes the window.

View EEPROM Buffer (Alt+E)

Same as “View EPROM Buffer” command except that the EEPROM buffer is being worked on.

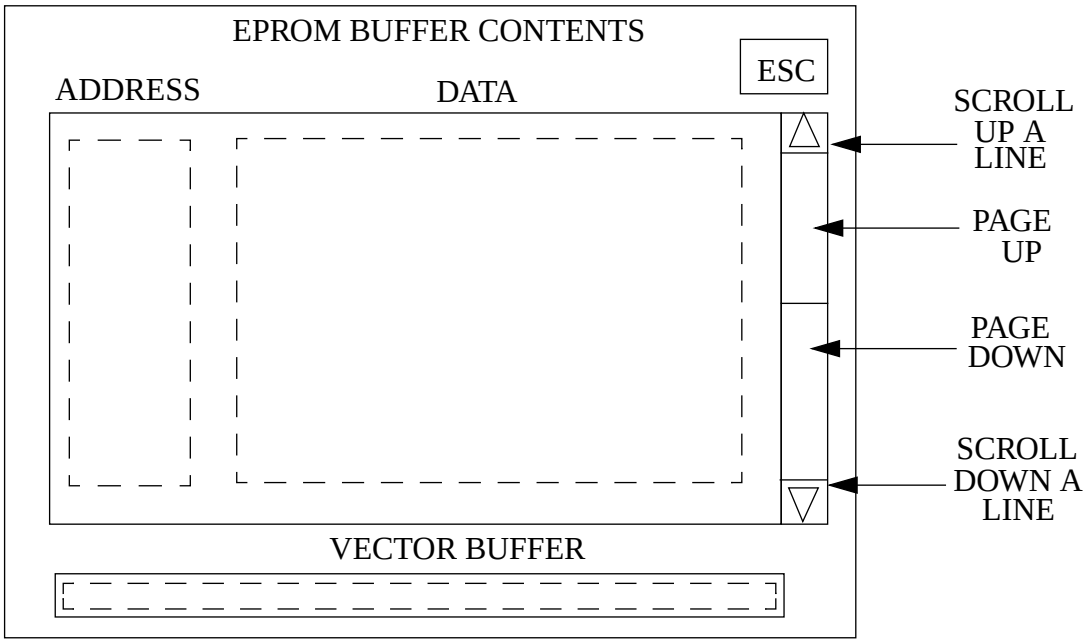

Figure 4-2 An “EPROM BUFFER CONTENTS” Window

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4.6.3 MCU MENU (Alt+M)

The MCU menu lets user program and verify the memory contents of the target MCU onboard the programmer. The MCU menu also lets user to perform Blank Checking and Uploading the MCU memory to the computer memory buffer for later operations. When this command is selected the interface software check if the programmer hardware (with MCU installed) is on-line. If so, the MCU menu will be opened. The following paragraphs provide an explanation of each command in the MCU menu.

Blank Check (Alt+B)

This command checks if the target MCU memory contents are at their erase state.

Upload (Alt+U)

This command reads and transfers the contents of the target MCU memory to the to the computer memory buffer.

Program (Alt+P)

This command opens the Program menu. The Program menu lets user to program the EEPROM or EPROM (including Vector locations) of the target MCU on board the programmer. The following two paragraphs provide an explanation of each command in the Program menu.

EEPROM (Alt+E : Works only when the Program menu is opened)

This command programs the EEPROM area(s) of the target MCU with the corresponding EEPROM memory buffer.

EPROM (Alt+O : Works only when the Program menu is opened)

This command programs the EPROM area(s) including the vector locations of the target MCU with the corresponding EPROM memory buffer.

Verify (Alt+V)

This command opens the Verify menu. The Verify menu lets user to verify the EEPROM or EPROM (including Vector locations) of the target MCU on board the programmer. The following two paragraphs provide an explanation of each command in the Verify menu.

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EEPROM (Alt+E : Works only when the Verify menu is opened)

This command compares the EEPROM area(s) of the target MCU with the corresponding EEPROM memory buffer.

EPROM (Alt+O : Works only when the Verify menu is opened)

This command compares the EPROM area(s) including the vector locations of the target MCU with the corresponding EPROM memory buffer.

4.6.4 Define MENU

Define menu lets user to define (i.e. specify) the address ranges of different memory areas including RAM, EEPROM, EPROM and VECTOR areas. It also lets user to define the Program Control Register(s) address(es). Defining memory address ranges tells the interface software to reserve memory buffer areas for data which reflects the contents of memory locations of the target MCU on board the programmer. All commands available in this menu open a “Memory Map Definition” window. A “Memory Map Definition” window consists of address cells to let user to input/modify the START and END addresses of memory blocks. The following paragraphs provide an explanation of each command in the Define menu.

EPROM Map (Alt+O)

This command opens the “EPROM Memory Map Definition” window to let user to input/modify address ranges of EPROM buffer blocks. The “EPROM Memory Map Definition” window also allow user to input/modify the EPROM Control Register address.

EEPROM Map (Alt+E)

This command opens the “EEPROM Memory Map Definition” window to let user to input/modify address ranges of EEPROM buffer blocks. The “EEPROM Memory Map Definition” window also allow user to input/modify the EEPROM Control Register and the EEPROM Option Register addresses.

VECTOR Map (Alt+V)

This command opens the “VECTOR Memory Map Definition” window to let user to input/modify address ranges of the vector buffer block.

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RAM Map (Alt+R)

This command opens the “RAM Memory Map Definition” window to let user to input/modify address ranges of RAM buffer blocks.

4.6.5 Set Port MENU (Alt+S)

The Set Port menu allows user to specify the serial port for data communication.

Set To COM1 (Alt+1)

This command sets COM1 for serial communication.

Set To COM2 (Alt+2)

This command sets COM2 for serial communication.

4.6.6 Quit (Alt+Q)

This command is available on the top menu bar it exits the interface environment and removes it from the computer memory.

4.7 A TYPICAL PROGRAMMING SEQUENCE

Although specific situation determines the most appropriate programming actions, the following steps will be typical for most users :

1) Use either of the following methods to initialize the target MCU parameters.

   - Select “Load Device Setting” command from the File menu to load the target MCU parameters.
   - Use commands in the Define menu to specify the memory map and programming register(s) addresses.

2) Select “Load User S19” from the File menu to load user S19 format data to the computer memory buffer.

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3) Select “Blank Check” from the MCU menu to blank check the target MCU memory. Memory must be blank before you can program them.

4) Select “Program” from the MCU menu to program the contents of memory buffer to the target MCU memory.

5) Select “Verify” from the MCU menu to verify programming.

6) To program another MCU, follow the steps in section 4.1 before removing the current MCU and inserting the new one.

7) When you are done programming MCUs, select “Quit” from the Menu Bar to exit the interface environment.

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CHAPTER 5

SUPPORT INFORMATION

This chapter contains serial connector pin assignments and signal descriptions, troubleshooting information for the M68HC705UPGMR.

5.1 RS232 SERIAL CONNECTOR PIN ASSIGNMENT

Connector P2 on the M68HC705UPGMR Universal Programmer Board is a DB 25-pin connector for 25-lead serial cables. Figure 5-1 shows the pin assignment of this connector and Table 5-1 describes the signals on P2.

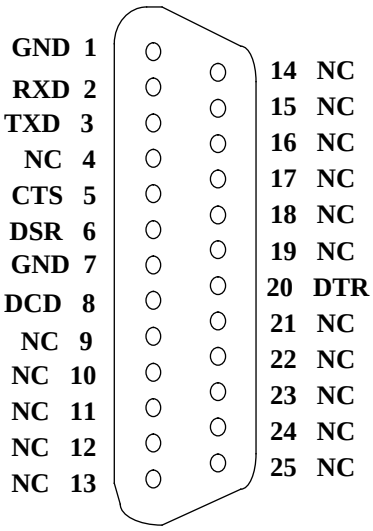

Figure 5-1 Connector P2 Pin Assignment

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PIN	NAME	SIGNAL
1	GND	Ground
2	RX	Receive Data - Serial Data Input Line
3	TX	Transmit Data - Serial Data Output Line
4, 9 - 19, 21 - 25	----	No Connection
5	CTS	Clear To Send - Connected to DSR, DCD and DTR
6	DSR	Data Set Ready - Connected to CTS, DCD and DTR
7	GND	Ground
8	DCD	Data Carrier Detect - Connected to CTS, DSR and DTR
20	DTR	Data Terminal Ready - Connected to CTS, DSR and DCD

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5.2 TROUBLESHOOTING

Table 5-2 lists possible problems and corrective actions for your M68HC705UPGMR programmer.

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
Device(s) fail to verify after programming **(PARALLEL MODE)**	Incorrect address jumper installed	Check parallel hardware connection procedure, refer to section 2.2.1
Unable to open MCU Menu. **(SERIAL MODE)**	1. Programmer is off-line.	Check: (a) MCU is installed on board programmer. (b) Cable is correctly connected. (c) Power on reset the programmer and try the command again.
	2. Bad MCU.	Turn OFF programmer power, replace MCU and reset programmer.
	3. COM port mismatch.	Try both COM ports, with commands in “Set Port” menu.
	4. Inappropriate cable	Be sure to use the correct cable between the programmer and the computer.
	5. Wrong Mode	Make sure SW1 is correctly set.
	6. Memory Map and Pro gram Control Register addresses not defined correctly	Make sure Memory Map and Program Register(s) addresses are defined; use “Define” menu.
MCU fails to verify after programming **(SERIAL MODE)**	Wrong Programming Control Register(s) address(es)	Use “Define” menu to check the Programming Control Register(s) address(es).

Table 5-2 TroubleShooting

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